

30 March 1970

Materiel Test Procedure 10-4-013
U. S. Army Arctic Test Center

U. S. ARMY TEST AND EVALUATION COMMAND
ENVIRONMENTAL TEST PROCEDURE

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ARCTIC ENVIRONMENTAL TEST OF PETROLEUM HANDLING EQUIPMENT
(POL PUMPING EQUIPMENT, MANIFOLDS, AND METAL STORAGE TANKS)

1. OBJECTIVE

The object of this MTP is to provide a means of evaluating the performance, human factors engineering, safety characteristics, and maintenance evaluation of petroleum handling and associated tools and equipment under arctic winter environmental conditions.

2. BACKGROUND

Valid comparisons of different designs of petroleum handling equipment are necessary to insure selection of the most suitable equipment in a natural arctic winter environment. Testing for use in an arctic winter environment is used to substantiate or supplement data obtained from simulated tests conducted during the Engineer Design and Engineering Test phase. Testing in the arctic winter environment generally is not authorized until data from simulated environmental tests provide reasonable assurance that the test item will function satisfactorily when subjected to the conditions that would be encountered in the arctic.

3. REQUIRED EQUIPMENT

- a. Appropriate Arctic winter uniforms and individual field gear
- b. Meteorological support facility
- c. Platform scales
- d. Photographic equipment (black and white or color)
- e. Steel measuring tape
- f. Vehicles (cargo)
- g. Flowmeters
- h. Pressure gage
- i. Thermometer (cup-type)

REFERENCES

- A. AR 70-38, Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions.
- B. AR 705-5, Army Research and Development.
- C. AR 70-8, Human Factors and Social Sciences Research.
- D. AR 70-10, Test and Evaluation During Research and Development of Materiel.
- E. AR 750-6, Maintenance Support Planning.
- F. USATECOM Regulation 705-2, Documenting, Test Plans and Reports.
- G. USATECOM Regulation 350-6, Training in New or Modified Equipment and Training Devices.
- H. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.

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a. Since arctic winter environmental tests are normally scheduled from October through March (6 months), ensure that the test items are delivered to the Arctic Test Center prior to 1 October.

b. TDY personnel shall be used to augment assigned personnel and shall be trained to the degree that they are as proficient on the individual test items as the troops who will use the equipment.

c. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC), and record this criteria in the test plan.

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same type of equipment, and familiarize all test personnel available for reference.

e. Record the grade, MOS, background, and training of all test personnel and ensure that all personnel receive New Equipment Training (NET).

f. Record the following information:

- 1) Nomenclature, serial number(s), and manufacturer's name of the test items.
- 2) Nomenclature, serial number(s), accuracy tolerances, calibration requirements, and last date calibrated of the test equipment which is used to obtain test data.

g. Select test equipment ideally having an accuracy 10 times greater than that of the specified tolerance of the function to be measured.

h. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation.

i. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test. Ensure that a Safety Release has been obtained prior to test conduct.

j. Outfit all test personnel in appropriate arctic winter clothing as described in MTP 10-4-500.

k. Record the prevailing meteorological conditions during the test conduct and storage phase to include:

- 1) Temperature
- 2) Humidity, relative or absolute
- 3) Temperature gradient
- 4) Atmospheric pressure
- 5) Precipitation
- 6) Solar radiation
- 7) Wind speed and direction
- 8) Frequency of readings
- 9) Source of data

6.2 TEST CONDUCT

The following tests shall be conducted in ambient air temperatures of 0°F to the lowest available temperature.

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6.2.1 Preoperational Inspection and Physical Characteristics

Upon receipt, carefully inspect all test items and their shipping or packaging containers for completeness, damage and general conditions in accordance with the applicable sections of MTP 10-4-500.

6.2.2 Transportability

- a. Inspect the test item and accessories for loose, damaged or missing parts and place in the best possible condition.
- b. Load the test item and accessories into a vehicle (cargo) in accordance with appropriate technical manuals.
- c. Transport the test item over established cross-country trails and secondary roads, reference MTP 10-3-503.
- d. Off-load and uncrate the test item and accessories and inspect for loose, damaged or missing parts.
- e. Operate the test item.
- f. Record the following data:

- 1) Description of manpower and/or equipment plus the time required to prepare, load and off-load the test item from vehicle.
- 2) Maximum and minimum ambient air temperatures during transport.
- 3) Mileage accumulated and road conditions.
- 4) Difficulties encountered during loading, off-loading and transport.
- 5) Results of inspections.
- 6) Damage which resulted from transport and appropriate photographs.
- 7) Malfunctions.

6.2.3 Installation

- a. Inspect the test item for loose, damaged or missing parts and place in the best possible condition.
- b. Install the test item in accordance with appropriate technical manuals.
- c. Record the following data:
 - 1) Ambient air temperatures and wind velocities.
 - 2) Type, quantity of engineer equipment, and special skills required for site preparation.
 - 3) Description of ground surface and the dimensions of the completed site.
 - 4) Number of men and time required to assemble and disassemble the test item.
 - 5) All difficulties encountered during assembly and disassembly.
 - 6) Photographs of the test site, assembly and disassembly.

6.2.4 Functional and Operational Suitability

6.2.4.1 POL Pumping Equipment

- a. Inspect the test item for loose, damaged or missing parts and place in the best possible condition.
- b. Install a flowmeter on the test item for measurement of fuel flow and amount.
- c. Commence operation of the test item in accordance with instructions given in the draft technical manual.
- d. The test item shall use fuels as specified in appropriate QMR's and SDR's.

NOTE: During operation only minor adjustment to the test item will be performed. All excess adjustments will be recorded.

- e. Record all engine shutdown time and results of engine examinations.
- f. During the first test run, stop the engine for 3 minutes after the first 4 hours of running and inspect the test item for leakage through the pump case, piping, fittings, or at the pump shaft seal, and for any malfunction of components.
- g. Operate the test item in low ambient temperatures for as long a period of time as is practical consistent with the availability of low ambient air temperatures, adequate manpower and product movement.
- h. Record the following data:
 - 1) Ambient air and product temperature.
 - 2) Adjustments required.
 - 3) Type of fuel being pumped through the test item.
 - 4) Total gallons of each type of fuel pumped through the test item.
 - 5) Leakage.
 - 6) Average pumping rate (GPM).
 - 7) Total hours of operation.
 - 8) Occasions of fault indicator alarm actuation and the circumstances.
 - 9) Results of inspections.

6.2.4.2 POL Manifolds

- a. Inspect the test item for loose, damaged or missing parts and place in the best possible condition.
- b. Commence operation of the test item in accordance with instructions given in the draft technical manual.

NOTE: The test item shall be operated with standard military fuels.

- c. Install a flowmeter on the test item for measurement of fuel flow and amount.
- d. Start and stop the pump several times and determine the ability of the test item to sustain fuel flow surge reactions resulting from these starting and stopping operations.

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e. Determine whether the test item is of sufficient length to permit joining of additional tanks to the system.

f. Operate the test item in low ambient temperatures for as long a period of time as is practical consistent with the availability of low ambient air temperatures, adequate manpower and product movement.

g. Throughout all operations inspect the test item for malfunctions of components.

h. Record the following data:

- 1) Ambient air and product temperatures
- 2) Type of fuel being pumped through the test item
- 3) Total gallons of each type fuel pumped through the test item
- 4) Average pumping rate (GPM)
- 5) Total hours of operation
- 6) Effects of flow fluctuations, if any
- 7) Results of inspections
- 8) Ability to accommodate additional tanks

6.2.4.3 POL Metal Storage Tanks

a. Following initial installation, fill the test item to capacity with fuel and allow to remain in static storage for a 60-day period.

b. Draw off product samples from the test item at the beginning, middle and end of the static storage phase.

NOTE: Product samples shall be analyzed and compared with test criteria and appropriate military specifications to determine contamination of POL products due to the test item. Reference MIL-F-8901B and MTP 9-2-298.

c. Following the static storage phase drain the test item and perform a fill-drain cycle once each week for four weeks as follows:

- 1) Fill to capacity one cycle and drain
- 2) Refill to half-capacity one cycle and drain
- 3) Refill to three-quarter capacity and drain for two cycles

d. During step c, above, the pumping will be interrupted periodically and the flow rate varied to determine the effects of flow fluctuation of the test item.

e. Determine the flow rate and the amount of product that cannot be withdrawn during step c, above.

f. Inspect the test item continuously during fuel transfer operations and daily during static storage phases for any malfunction.

g. Record the following data:

- 1) Ambient air temperature
- 2) Product temperature
- 3) Effects of snow, ice and air temperature
- 4) Rate at which the test item can be filled and emptied (GPM)
- 5) Effects of flow fluctuations

- 6) Amount of product that cannot be withdrawn
- 7) Storage capacity of the test item
- 8) Summary of product analysis
- 9) Result of inspections
- 10) Length of storage
- 11) Malfunctions

6.2.5 Human Factors Engineering and Safety

- a. Conduct all Human Factors and Safety tests in accordance with the applicable sections of MTP 10-4-500.
- b. Conduct these tests to the maximum extent possibly concurrently with the operational tests (Transportability, Installation, and Functional and Operational Suitability).

6.2.6 Maintenance Evaluation

- a. Conduct all maintenance evaluation tests (maintenance and reliability) in accordance with applicable sections of MTP 10-4-500.
- b. Conduct these tests concurrently with the operational tests (Transportability, Installation and Functional and Operational Suitability as described in this MTP).

6.3 TEST DATA

All test data to be recorded will be as specified in the individual subtests of this MTP.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to test title.

Specific instructions for the reduction and presentation of individual test data are outlined in the succeeding paragraphs.

6.4.1 Preoperational Inspection and Physical Characteristics

Preoperational inspection and physical characteristics data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.2 Transportability

The suitability of the test items to be transported under arctic winter environmental conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the test items attributed to transporting shall be compared with test item specifications contained in appropriate QMR and TC.

6.4.3 Installation

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The suitability of the test items for installation under arctic winter environmental conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the test items attributed to installation shall be compared with test item specifications contained in appropriate QMR and TC.

6.4.4 Functional and Operational Suitability

Examine the recorded data and evaluate the suitability of the test item in arctic environment by determining if it meets or exceeds the appropriate specifications contained in QMR's, SDR's, TC's and Test Directives. Data recorded in paragraph 6.2.4 shall be reviewed to determine functional suitability.

6.4.5 Human Factors Evaluation and Safety

Human factors engineering and safety shall be reduced and presented in accordance with MTP 10-4-500.

6.4.6 Maintenance Evaluation

Maintenance data shall be reduced and presented in accordance with MTP 10-4-500.

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13. ABSTRACT This Environmental Test Procedure describes test methods and techniques for evaluating the performance and characteristics of Petroleum Handling Equipment (POL Pumping Equipment, Manifolds, and Metal Storage Tanks) under Arctic Winter Environmental conditions. The evaluation is related to the criteria prescribed in applicable Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other applicable design requirements and specifications. (1) ↑		

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